

November 21, 2019

Ms. Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, D.C. 20554

*Re: Notice of Ex Parte Presentation, IB Docket No. 11-109; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091, SAT-AMD-20180531-00044, SAT-AMD-20180531-00045, SES-AMD-20180531-00856*

Dear Ms. Dortch:

The Commission has expended significant time and resources to consider the license modification applications Ligado filed on December 31, 2015 (“License Modification Applications”). With the extensive filings in response to the April 2016 Public Notice by a number of parties, Ligado has sought to ensure that the record before the Commission with respect to the License Modification Applications is complete and that Ligado has responded to all stakeholder concerns in the record as well as concerns Commission staff have raised. Notwithstanding these substantial efforts on the part of both Ligado and the Commission staff, the Department of Defense (“DOD”) continues to argue that the Commission should ignore its rules and instead apply an undefined metric of a 1 decibel change in the noise floor (1 dB C/N<sub>0</sub>) to the License Modification Applications, which would render this spectrum and many other bands of spectrum commercially obsolete. The Secretary of Defense—apparently having been told by his staff that the power equivalent to what is generated by a 10 Watt light bulb could have a significant negative impact on military operations that rely on GPS—has asked the Chairman to reject Ligado’s License Modification Application. Ligado takes this opportunity to respond directly to the DOD.

Ligado submits this letter to (1) bring into the open points that have been raised by the DOD behind the scenes for months in an effort to prevent the FCC from ruling on Ligado’s License Modification Applications and thereby avoid having those points subject to technical or legal review before the Commission or in court, (2) highlight that the DOD’s request is not grounded in any data or information that is in the docket, and (3) demonstrate that DOD is urging the Commission to ignore its rules and adopt a 1 dB C/N<sub>0</sub> metric that is not a standard, has never been used domestically or internationally for this purpose, and would cripple the potential of Ligado’s spectrum to advance 5G. Now that these DOD concerns have been (finally) put on the record, the Commission should bring to an end the unreasonable delay that has plagued this proceeding and approve the pending License Modification Applications.

### **Executive Summary**

The issue raised by the DOD letter is not new to the Commission, and the record contains ample evidence for the Commission to conclude that the assertions in the letter lack merit. As presented in the DOD letter, the question for the Commission in assessing the Modifications Applications is this: whether to use the standard embedded in the FCC's rules, or instead, act arbitrarily and capriciously and use a metric that is not defined, has never been used for this purpose by the Commission or any international spectrum regulator, and is inconsistent with the Commission's rules.

This issue was brought to the Commission's attention by then-Acting Secretary Shanahan in June of this year. The June 2019 letter makes virtually the same points as made in the November 2019 letter. As with the letter from Secretary Esper, the letter from Acting Secretary Shanahan offered no technical or legal support for the request that the Commission reject Ligado's proposal; four months later, the Department still offers no new arguments, no new analysis, and no new facts—relying instead (as it has for years) on the Department of Transportation ("DOT") study that has been before the Commission for more than 18 months. The Commission's decision-making must be guided by the Administrative Procedure Act, 5 U.S.C. §500 *et seq.* (the "APA"). The DOD letter provides no specific or technical information relevant to the question before the Commission and lacks any data or legal theory that would justify applying a 1 dB metric to spectrum adjacent to GPS bands. In fact, the evidence before the Commission supports the opposite conclusion: the proposal in the License Modification Applications will protect GPS, as it was designed to do, and GPS will not suffer harmful interference if the Commission approves the proposal.

As set forth in detail below, the DOD letter makes several assertions that are not supported by the evidence in the Commission record nor by long-standing Commission precedent and the policies of our Nation. Notably, the implication of the DOD letter is that the most sophisticated weapon systems in the world are vulnerable to the energy generated by the equivalent of a 10 Watt lightbulb, since that is the power level Ligado has proposed for the band closest to GPS. As a matter of administrative law and spectrum policy, the DOD's request appears to be an attempt to grab spectrum not currently allocated to it and allocated many years ago to a commercial company. Finally, the Department's request that the Commission use a metric tied to the most minute change in background noise, as recommended in the DOT Report, would render over 200 megahertz of spectrum commercially worthless and seriously impair our ability to make progress toward 5G.

Almost four years have passed since the FCC first began considering the License Modification Applications. Now that the DOD has finally shared its view with the Commission and the public, consistent with the APA, the Commission can evaluate the License Modification Applications under its rules, determine how best to protect GPS, and render a final decision to make this vital mid-band spectrum available now. As DOD makes clear in its letters, the authority to decide rests with the FCC and the FCC alone.

Responses to specific DOD assertions are set forth below.

***DOD Assertion: DOD Has Statutory Authority to Sustain and Operate GPS***

*Response: That is true, but the FCC has exclusive authority to make spectrum decisions and determine how GPS and other spectrum users will be protected.*

The DOD seeks to make much of the point that 10 U.S.C. § 2281 directs the Secretary of Defense to provide for the sustainment and operation of the GPS Standard Position Service. That is true, but that statutory language in no way curtails the authority of the FCC, since Congress assigned to the Commission the *exclusive* authority to determine how spectrum should be allocated and used.<sup>1</sup> This authority is neither superseded nor diminished by 10 U.S.C. § 2281. The DOD may have a view on how it would like to implement its statutory directive, but the Commission's statutory obligation as the expert agency is to execute its responsibility under the Communications Act of 1934, 47 USC §151 *et seq.*, and to make spectrum decisions based on facts and analysis in the record, as required by the APA.

To further underscore the central and exclusive role of the Commission in making spectrum decisions, Congress explicitly affirmed the FCC's exclusive authority over this specific question. On December 23, 2016, Section 1698 of the [FY2017 NDAA](#) became law, and it plainly asserts that the FCC has jurisdiction over spectrum management decisions related to GPS. In the process, FY17 NDAA repealed previous language inserted in the FY12 NDAA. The FY17 NDAA followed a lengthy examination by the Armed Services Committees, and it recognizes the FCC's authority and expertise in making spectrum decisions relating to appropriate GPS frequency protections. In short, that law affirms the clear statement in the Communications Act: the FCC is exclusively charged with resolving issues regarding GPS and spectrum allocation. We are requesting that the FCC resolve this issue consistent with Section 1698 of the FY17 NDAA, the Communications Act, and the APA.

***DOD Assertion: GPS Signals and Service Must be Protected Based on the Importance of GPS***

*Response: GPS is indeed important, and Ligado's agreements with the GPS manufacturers and the extensive testing and extensive evidence in the record shows it will be protected.*

Ligado agrees, as does every other party in this proceeding, with the proposition that GPS is important. We have made that point not just in the 2015 License Modification Applications filing but in virtually every filing since. It is undeniable that GPS is critically important, which is

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<sup>1</sup> See 47 U.S.C. §303. See also *Head v. New Mexico Bd. of Examiners in Optometry*, 374 U.S. 424, 430 n.6 (1963) (affirming that the jurisdiction of the FCC over technical matters associated with the transmission of radio signals "is clearly exclusive"); *New York SMSA Ltd. P'ship v. Town of Clarkstown*, 612 F.3d 97, 100 (2d Cir. 2010) (Congress "intended the FCC to possess exclusive authority over technical matters related to radio broadcasting"); *Broyde v. Gotham Tower, Inc.*, 13 F.3d 994, 997 (6th Cir. 1994) (discussing "the FCC's exercise of exclusive jurisdiction over the regulation of radio frequency interference").

why the company substantially altered its spectrum plan by creating a 23 megahertz guard band for GPS, and dramatically reducing its power levels and out of band emissions (“OOBE”) limits to protect GPS, as reflected in the License Modification Applications. Importantly, Ligado did not select those power levels and OOBE limits alone; rather, those operating parameters came directly from the company’s discussions with the major GPS manufacturers. In addition, the compromises Ligado made were informed by discussions with GPS and spectrum experts within the DOD and the NTIA. Indeed, those power levels and OOBE limits were so important to the GPS manufacturers that they required the company to submit those parameters to the Commission in the form of the License Modification Applications.<sup>2</sup> This requirement is evidence not just that these concessions were important to the GPS companies, but also that they—and presumably the devices they market and sell to consumers—were able to co-exist with the new parameters.

The record before the Commission reflects this commitment to protect GPS devices:

- Ligado reached co-existence agreements with the five major GPS device manufacturers<sup>3</sup> (agreements that resulted in the development of operating parameters proposed in the License Modification Applications and Ligado’s commitment to create a guard band for GPS by giving up the terrestrial rights to one fourth of its licensed spectrum).
- The National Advanced Spectrum and Communications Test Network (“NASCTN”) lab run by the DOD and NIST at Boulder, Colorado conducted thousands of hours of testing to determine whether Ligado’s operations would cause harm to GPS devices.<sup>4</sup> Ligado agreed to have these tests conducted by NASCTN at the request of the DOD Chief Information Officer’s office.

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<sup>2</sup> See Letter from Gerard J. Waldron, Counsel to New LightSquared LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 12-340; IB Docket No. 11-109; IBFS File Nos. SAT-MOD-20101118-00239; SAT-MOD-20120928-00160; SAT-MOD-20120928-00161; SES-MOD-20121001-00872; SES-RWL-20110908-01047; SES-MOD-20141030-00835 (“captioned dockets”), at 4 (Dec. 8, 2015); Letter from Gerard J. Waldron, Counsel to New LightSquared LLC, to Marlene H. Dortch, Secretary, FCC, [captioned dockets], at 25 (Dec. 17, 2015); Letter from Gerard J. Waldron, Counsel to New LightSquared LLC, to Marlene H. Dortch, Secretary, FCC, [captioned dockets], at 4, 7, 19 (Feb. 3, 2016); Letter from Doug Smith, CEO, Ligado Networks LLC, and Ivan Di Federico, Chief Strategy Officer, Topcon Positioning Systems, Inc., to Marlene S. Dortch, Secretary, FCC, IB Docket No. 11-109 (Nov. 29, 2016); Letter from Doug Smith, Ligado Networks LLC, and Michael Ritter, NovAtel Inc., to Marlene Dortch, Secretary, FCC, IB Docket No. 11-109 (June 27, 2016).

<sup>3</sup> A sixth GPS device manufacturer, Septentrio, has filed in the docket affirming its compatibility with Ligado’s proposed operations. See Letter from Neil Vancans, Vice President of Global Sales, Septentrio, to Marlene Dortch, Secretary, Federal Communications Commission (Oct. 5, 2018). (“Septentrio hardware and Ligado services are complementary. ... Ligado’s proposed operating parameters fall within the type of interference GNSS receiver[s] can be immune to by design.”)

<sup>4</sup> See Dr. William Young *et al.*, NASCTN, *LTE Impacts on GPS: Test and Metrology Plan* (July 22, 2016), available at <https://www.nist.gov/sites/default/files/revised-test-plan-impact-of-lte-on-gps-22-july-2016.pdf> (“NASCTN Report”).

- Ligado further and dramatically amended its Modification Applications in May 2018 with respect to its 1526-1536 MHz band (the “Lower Downlink”) to reflect the power level recommended by the DOT to protect certified aviation devices<sup>5</sup>. This change constitutes a reduction that is 99.3% below the level that the GPS companies had agreed to for commercial GPS devices.<sup>6</sup>

The extensive testing and the co-existence agreements described above establish that the operations of GPS devices will not be compromised—*i.e.*, they will not experience harmful interference from Ligado. The DOD tries to disparage the testing conducted at NASCTN, which is odd since DOD cosponsors that lab, on the grounds that the NASCTN testing was done under a Cooperative Research and Development Agreement (“CRADA”) with Ligado. That dog won’t hunt. CRADAs have long been recognized as a “major tool for industry-government cooperation.”<sup>7</sup> Indeed, some of the nation’s highest-ranked military officers have specifically referenced CRADAs as providing a key mechanism to “accelerate,”<sup>8</sup> and “advance”<sup>9</sup> military research. This Administration itself has emphasized the importance of CRADAs; earlier this year the Department of Energy cited its “approaches to increas[e] the impact of CRADAs” as key elements of its commitment to “support innovation and commercialization.”<sup>10</sup>

Ligado has undertaken this extensive research effort out of a profound recognition that GPS services are critically important. As the attached declaration from Dennis Roberson establishes, both the NASCTN and the Roberson and Associates testing reflect a rigorous scientific approach that produced results that are repeatable, verifiable, and able to be proven true or false.<sup>11</sup> Moreover, those tests assessed the standard that the FCC applies to spectrum decision involving GPS: harmful interference. Accordingly, in its decision on Ligado’s License Modification Applications, the Commission must rely on those tests, which are in the record, and not on hollow, unsubstantiated claims.

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<sup>5</sup> U.S. Department of Transportation, *Global Positioning System (GPS) Adjacent Band Compatibility Assessment Final Report*, at 158 (April 2018), <https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf> (“ABC Study”).

<sup>6</sup> See Reply Comments of Ligado Networks LLC, [captioned dockets], at 17–18 (July 19, 2018) (“July 2018 Reply Comments”); Letter from Gerard J. Waldron, Counsel to Ligado Networks LLC, to Marlene H. Dortch, FCC Secretary, [captioned dockets], (June 5, 2017) at 9–10, Appendix A.

<sup>7</sup> H.R. REP. NO. 106-129, at 7 (1999).

<sup>8</sup> *Defense Health Program: Hearing Before the Subcommittee on Defense of the Senate Committee on Appropriations*, 115th Cong. 26 (statement of Vice Admiral C. Forrest Faison III).

<sup>9</sup> *Department of Defense Authorization for Appropriations for Fiscal Year 2018 and the Future Years Defense Program: Hearing Before the Committee on Armed Services*, 115th Cong. 30 (2017) (statement of Maj. Gen. Chris P. Weggeman).

<sup>10</sup> *The State of Energy Innovation: Hearing Before the Senate Energy and Natural Resources Committee*, 116th Cong. 6 (2019) (statement of Under Secretary for Science Paul M. Dabbar).

<sup>11</sup> See Roberson Affidavit (Attachment A).



***DOD Assertion: Because GPS Is So Important, It Should be Entitled to Use Spectrum Allocated to Others***

*Response: GPS devices are important and they will be protected, but no entity has the authority to squat on someone else's spectrum and seek to use spectrum not allocated to it.*

This claim warrants three responses. *First*, the License Modification Applications would give GPS devices a measure of extraordinary protection. If the Commission approves Ligado's License Modification Applications, a 23 megahertz guard-band or buffer zone will separate Ligado and GNSS. That is a tremendous amount of valuable terrestrial spectrum that will lie fallow for one reason only: to protect GPS. *Second*, DOD is now seeking to expand the GPS spectrum far beyond what it agreed to previously. The NTIA and the Air Force long ago agreed that GPS receivers were not entitled to protection outside of their designated band. Specifically, as reflected in GPS BLKIII Satellite Payload Spectrum Certification JF 12/09603, OMB Circular A-11 of July 12, 1999, and OMB Circular A-11 of August 18, 2011:

The certification of the GPS-III satellite in May 2010 made it clear that NTIA and the Air Force had agreed that *GPS receivers were not entitled to protection for a bandwidth of greater than 24 MHz (extending from 1563-1587 MHz, outside the spectrum on which LightSquared intends to operate).*

Thus, since May of 2010, the key players within the DOD involved with spectrum and GPS policy and operations have recognized and agreed *that GPS receivers are not entitled to protection from operations in bands assigned to Ligado*. Notwithstanding this recognition, Ligado has made extraordinary offers to be accommodating and address GPS concerns by relinquishing ten megahertz of spectrum to create a guard-band and dramatically reducing its power in the "Lower Downlink" by more than 99.9% from the level authorized in 2010 and more than 99.3% from the maximum reflected in the License Modification Applications.

*Third*, no one has offered an iota of information in the record to provide a technical or legal rationale to support the claim being asserted by some within the DOD that Ligado's proposal will impact GPS. Their position seems to be that an unsupported desire to seize neighboring spectrum for GPS out of an unproven fear of potential interference should be sufficient, but that is not how spectrum decisions are made under the Commission's rules and the APA. Moreover, that claim lacks any articulated technical basis, which the Commission has called for,<sup>12</sup> and the Commission

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<sup>12</sup> *Comment Sought on Ligado's Modification Applications*, IB Docket Nos. 11-109 & 12-340, DA 16-442 (April 22, 2016) ("2016 Public Notice"), at 8 ("To the extent any commenter asserts that there remains potential for harmful interference from the proposed terrestrial operations (under the agreed-upon technical parameters) in the [named bands], we seek information on the basis for these concerns . . . . We request that such commenters supply specific relevant technical information about affected GPS receivers

cannot make decisions on mere conjecture.<sup>13</sup> The FCC long ago decided to grant Ligado a license to use this spectrum for terrestrial services. DOD is arguing for a *de facto* reallocation of the spectrum from Ligado to GPS—a position that does not stand up to legal or factual scrutiny.

***DOD Assertion: Unidentified Potential Unknowns Could Pose Risks to GPS.***

*Response: The Commission asked for specific and technical information on how GPS devices will be protected; after four years and thousands of hours of testing by a DOD-sponsored lab a citation to ambiguous “unknowns” fails to meet the burden under the APA.*

As we understand this vague concern, some at the DOD apparently are of the view that there are too many unknowns and those unknowns pose risks to GPS that are too great to allow Ligado’s proposed operations to proceed. The proceedings of the Commission, including the adjudication of the instant License Modification Applications, are governed by the APA and require the basic elements of due process. As Chief Justice Roberts recently stated, “The reasoned explanation requirement of administrative law, after all, is meant to ensure that agencies offer genuine justifications for important decisions, reasons that can be scrutinized by courts and the interested public.”<sup>14</sup> A vague, unsubstantiated, and undefined claim—even one about national security or military operations—fails the rigor of the agency decision-making process generally. More specifically, the Commission made explicitly clear when it issued the public notice on Ligado’s License Modification applications in 2016, that it sought “specific comment on . . . any unresolved concerns” and asked for “information on the basis of these concerns” including “specific relevant information about affected GPS receivers.”<sup>15</sup> Since 2012, the DOD has had an opportunity to present in the record any issues it saw as pertinent to addressing the risks to GPS since 2012, but it has failed to do so. The Commission thus lacks a basis under the law to give weight to the Department’s vague, unsubstantiated, and undefined claims.

Considering the extensive evidence Ligado and others, including other Federal agencies, have put forward regarding the potential impact of Ligado’s proposal on GPS, the DOD’s failure to do the same is particularly striking because the DOD conducted testing at the same time as the DOT did. It thus seems unlikely that the impact to national security or military operations would be unknown at this point (or even be discovered recently), given all of the evaluation and assessment that has been conducted by the DOD and others.

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. . . that support their assertion that additional measures would be necessary to resolve remaining concerns of potential harmful interference . . .”).

<sup>13</sup> See, e.g., *Settling Devotional Claimants v. Copyright Royalty*, 797 F.3d 1106, 1121 (D.C. Cir. 2015) (clarifying that an agency cannot satisfy its burden by “bridging over” a gap in the record with facts “that [do] not actually exist”); *Dist. Hosp. Partners, L.P. v. Sebelius*, 932 F. Supp. 2d 194 (D.C. Cir. 2013) (noting that although review of a final agency decision is “highly deferential,” the court will not uphold a decision when “[t]he agency has pointed to no persuasive evidence that supports [its] contention.”).

<sup>14</sup> See *Dep’t of Commerce v. New York*, 139 S. Ct. 2551, 2576, 204 L. Ed. 2d 978 (2019) (Roberts, C.J.).

<sup>15</sup> 2016 Public Notice, *supra* note 12, at 8.

Given how long these Modification Applications have been pending (almost four years), and the fact that the comment cycle closed over three years ago, the Commission has every basis to conclude that the DOD's lack of public communication about this issue means the Department lacks any legitimate basis for seeking to prevent the FCC from deciding Ligado's License Modification Applications and is doing so simply because it wants to expand the amount of spectrum allocated to GPS without going through the proper legal channels and without offering any objective technical evidence. During a workshop hosted by the DOT, a DOD official stated his view on Ligado's Modification Application. The DOD official stated that he could "speak for the Department of Defense" and said in response to concerns about earlier spectrum proposals for this band, that "...[t]hings do change, time moves on, and the Department is committed to making data-driven analysis, data-driven decisions, and we have done those with a number of other difficult, challenging spectrum frequency reallocation and sharing, and that's our approach to this." That statement was made over two years ago. Neither at the Workshop nor since then has anyone at the DOD offered any such data driven analysis or even any underlying data to consider. Indeed, when a DOT representative asked whether DOD planned to issue a report on the military GPS receiver testing, the DOD official explained that the Department would defer to the testing being conducted by the DOT. That deference was reiterated in the November 18, 2019 letter from the DOD to the Chairman which urges the FCC to adopt the DOT approach and indicates that data is the sole basis for the DOD's position. That test data is in the FCC record in Ligado's docket and has been for more than 18 months. There have been no subsequent efforts by the DOD to develop, obtain or provide to the FCC any additional information.

At this juncture, the License Modification Applications have been subject to thousands of hours of testing, and all parties, including the DOD, have had ample opportunity to conduct a study *if they were genuinely interested in finding results or providing information that meets the FCC's legal and technical standards*. Congress gave the Commission exclusive authority to make commercial spectrum decisions, and though the Commission can consult other agencies, it cannot delegate its decision-making authority to another agency. After nearly four years and ample opportunity for comment, the Commission should end this unreasonable delay and not wait any longer for input that may never appear.

***DOD Assertion: All Spectrum Bands Adjacent to GPS Should be Governed by 1 dB.***

*Response: 1dB is not a standard; it is not defined, measured, or reported consistently, and it has never been used for this purpose by spectrum regulators in the U.S. or internationally.*

The DOD claims that Ligado's proposed terrestrial operations should not be approved because they do not meet the transmission power limits described in the DOT's GPS Adjacent Band Compatibility Assessment Final Report ("ABC Study") released in April 2018.<sup>16</sup> In suggesting the Commission should adopt power limits from the DOT Report, the DOD is doing nothing more than requesting that the Commission set aside its long-standing rules and precedent and instead apply the 1 dB C/N<sub>0</sub> metric to services in bands adjacent to GPS, since the DOT power

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<sup>16</sup> See ABC Study, *supra* note 5.



limits were developed based solely on that metric. To be clear, reliance on, support for, or endorsement of the DOT ABC Study results is exactly the same thing as asking the FCC to apply 1 dB C/N<sub>0</sub> to Ligado's operations in a band that is 23 megahertz away from GPS; it is nothing more.

As Ligado has previously explained, however, the 1 dB metric is entirely inapplicable to its License Modification Applications.

- 1 dB is not “a standard” because it has never been defined. In addition, as data from the NASCTN study shows, 1 dB is measured and reported inconsistently and mostly incorrectly.<sup>17</sup> It would be arbitrary and capricious for the FCC to base any decision on such a flawed and undefined metric.
- Neither the Commission nor the ITU has ever used a standard of a 1 dB C/N<sub>0</sub> degradation to protect a service from *transmissions in an adjacent band*, which is the situation the License Modification Applications raise.<sup>18</sup> Simply repeating over and over again that 1 dB is the international standard does not make it true.
- The Commission's rules define “harmful interference” as “interference which endangers the functioning of a radionavigation service or other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with [the ITU] Radio Regulations.”<sup>19</sup> 1 dB C/N<sub>0</sub> is not a measure of harmful interference. The DOT has acknowledged this publicly and explained that 1 dB C/N<sub>0</sub> is instead an “interference protection criteria” and thus cannot be relied upon by the FCC to evaluate Ligado's License Modification Applications. In addition, the docket contains extensive evidence from NASCTN and also from Ligado on whether GPS devices will experience harmful interference. This evidence demonstrates that the overwhelming majority of GPS devices will not be affected, and those few high precision devices that may be affected can be readily upgraded or replaced. Under a reasoned decision making process, the Commission should look to its rules as well as to the evidence in the record based on its rules and responsive to its Public Notice to reach a decision on the merits without unreasonable delay.

There is thus no basis for concluding that GPS devices are entitled to a 1 dB level of protection from transmissions in an adjacent band or that they need such protection to continue to provide the service they were intended to provide—yet that is what the DOD apparently seeks.<sup>20</sup>

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<sup>17</sup> See NASCTN Report, *supra* note 4, at 271–75.

<sup>18</sup> See July 2018 Reply Comments, *supra* note 6 at 3. See also *id.* at Appendix A for additional information on the Commission's use of the 1 dB standard.

<sup>19</sup> 47 C.F.R. § 2.1(c).

<sup>20</sup> To be clear, Ligado has long agreed that a 1 dB change is the appropriate standard for *co-channel* (in-band) emissions (*i.e.*, emissions into the GNSS band). See, *e.g.*, July 2018 Reply Comments, *supra* note 6, at 15. Ligado's proposal clearly meets the standard in that band, the band that has been allocated to GNSS.

Indeed, it appears that the DOD is fully aware that 1 dB is not the standard for measuring adjacent band interference to GPS. There are even some who urged the DOD and others to abandon 1 dB as a metric several years ago knowing that the FCC and NTIA do not support its application to Ligado's proposal.<sup>21</sup> Specifically, it appears that DOD personnel who are long versed in spectrum issues recognize the inherent flaws in advocating for 1 dB as a useful metric.<sup>22</sup>

It also is important to put in context what the DOD is apparently seeking: an FCC determination that certain devices should be entitled to the most extreme level of protection when operating in spectrum assigned to others. Or to put it another way, when certain spectrum devices are squatting on spectrum allocated to another entity, they *still* should receive the most extreme protection imaginable, even when hard evidence shows those devices do not need that level of protection. This effort by the DOD has widespread implications, since if tolerated, it amounts to a *de facto* reallocation of spectrum outside of an APA process. The Air Force apparently recognized the obvious problem in that position when it agreed with NTIA in 2011 that it would not seek protection when GPS devices are operating in spectrum that is not theirs. While that seems like an obvious point—an *entity that is squatting on someone else's property should not be entitled to protections from the person lawfully authorized to use that property*—the DOD apparently rejects that proposition because it wants a bigger “neighborhood.” In pursuit of more spectrum for GPS, the DOD asserts that the 1 dB metric should be used, which would create an unfathomably large buffer zone for GPS and render valuable commercial spectrum allocated to someone else worthless.

***DOD Assertion: Energy Generated from the Equivalent of a 10 Watt Lightbulb Could Have a Negative Impact on Military Operations***

*Response: There is no evidence of a national security impact, and DOD apparently has no testing to back that remarkable claim.*

The Department states that the License Modification Applications implicate national security and/or military operations. That claim is remarkable since, if true, it means that some in the DOD believe that the most sophisticated military systems in the world can be stymied by the energy generated by the equivalent of a 10 Watt lightbulb, which is the power level recommended by the DOT Report to protect certified aviation devices and reflected in the License Modification Applications. As disturbing as that may be, let us set aside for now the implications that this claim, if true, would have for our enemies and return to what is true.

Ligado consulted extensively with the DOD's CIO office over a period of years to develop the proposal in the License Modification Applications and never heard about any national security concerns. Ligado consulted with that office and others in developing its current proposal and in developing a plan to test the proposal in a manner that would satisfy DOD's standards and meet

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<sup>21</sup> See Howard Buskirk, *Emails Show Federal Disagreements on Protection Standard for GPS*, Communications Daily (Nov. 5, 2019), at 2–3.

<sup>22</sup> *Id.*

its expectations. The DOD urged Ligado to have its proposal tested by NASCTN. Ligado did just that, and the test results confirm that device performance will not be negatively impacted by Ligado. Perhaps because neither the testing done by the Air Force nor the testing done by NASCTN yielded results that would support an assertion by the DOD that Ligado's proposal has negative national security implications, it appears that the DOD's remarkable claim is based on nothing more than the testing done by a civilian agency (the DOT) on civilian GPS devices. No DOD devices were tested in the DOT ABC Study, and there is no data in that Study relevant to national security. As Ligado has explained many times in the record, the DOT ABC Study is not so much of a study of the Ligado proposal as it is a study of 1 dB C/N<sub>0</sub>, a metric some at the DOT and the DOD wish would be used to assess interference in a spectrum band adjacent to GPS, but which has never been used by the Commission in this context. Those who support application of this metric to Ligado's spectrum are and have been for years fully aware that it is not the current standard and that its application is not supported by the FCC or the NTIA.<sup>23</sup>

In addition, the 2010 Memorandum of Understanding indicates the DOD does not need the type of spectral separation for GPS devices that some at the DOD are now demanding. It defies logic that after nine years of technology development, the DOD would claim that they need *more* protection than the Air Force agreed to in 2010. Even the PNT EXCOM Letter, which some at DOD apparently rely on for their view, focuses exclusively on the debate over 1 dB and does not even raise that issue.<sup>24</sup> We further understand that the Senate Armed Service Committees and the Senate Intelligence Committee have specifically asked whether any national security concerns exist and have been told no. Ligado has been told repeatedly by multiple Administration officials that no information or studies exist beyond what is in the FCC's record to substantiate the DOD's vague and unsubstantiated claims. Thus, any national security concerns are being invoked as a threat in the hope that they will prevent the FCC from judging—consistent with its authority—a debate based on facts and the law.

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For the reasons described above, Ligado respectfully submits that the concerns raised in the DOD's letter lack merit and only serve to further delay a proceeding that has already

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<sup>23</sup> See *id.*

<sup>24</sup> Some at DOD point to a December 3, 2018 letter from the National Executive Committee for Space-Based Positioning, Navigation, and Timing ("PNT EXCOM") to the Administrator of NTIA recommending against approving the License Modification Applications as dispositive. Yet NTIA, the designated spectrum policy making body inside the Executive Branch, reviewed this letter and other evidence before it and issued a report on September 3, 2019 that concluded: the "next step[]" with respect to Ligado's Modification Applications is for the FCC to "issue a determination" on the pending Applications.

Ms. Marlene H. Dortch

November 21, 2019

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run unreasonably long.<sup>25</sup> Accordingly, the Commission should move swiftly to approve the License Modification Applications.

Please direct any questions to the undersigned.

Sincerely,

/s/ Valerie Green

Valerie Green

Executive Vice President and  
Chief Legal Officer  
Ligado Networks

Attachments

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<sup>25</sup> Though the Department has chosen to not put its formal views expressed to an agency governed by the APA on the record, in the interest of transparency the June 2019 letter and the nearly identical November 2019 letter from the Department are attached hereto.

## **Attachment A**

### **DECLARATION OF DENNIS ROBERSON**

I, Dennis A. Roberson, hereby state as follows:

1. I am the President and Chief Executive Officer of Roberson and Associates (“RAA”), a wireless technology-focused consulting company. I have had an extensive career in the private sector, serving in business and technology roles at IBM, the Digital Equipment Corporation (now part of HP), AT&T, and NCR. I have previously served as Motorola’s Executive Vice President and Chief Technology Officer.
2. I am a research professor at the Illinois Institute of Technology (IIT), where I co-founded the Wireless Network and Communications Research Center and the Intellectual Property Management and Markets Program, of which I am currently Co-Director. My research focus has been in the areas of heterogeneous dynamic spectrum access networks; spectrum observation, measurement and management; and wireless interference and mitigation. Before my current academic positions, I was Vice Provost for Research at IIT. I received B.S. and B.S.E.E. degrees in Physics from Washington State University and an M.S.E.E. from Stanford University.
3. I have advised many companies on spectrum issues and conducted numerous tests and studies assessing spectrum bands and the use of such bands on adjacent users for over two decades. RAA has submitted numerous studies analyzing spectrum issues to the FCC and also have advised multiple U.S. Executive Branch departments on spectrum matters. I also have served as an expert witness in various proceedings, and am currently serving as an expert witness in the litigation around the Sprint/T-Mobile merger. In addition to my corporate and academic positions, I serve as the Chair of the Federal Communication



Commission's Technological Advisory Counsel and am a member of the Commerce Spectrum Management Advisory Committee.

4. This declaration is based upon my personal knowledge, and I understand that this declaration may be submitted to the Federal Communications Commission ("FCC").
5. In my professional opinion, there are a few key features that distinguish a study as being scientifically valid. One is if a test plan was developed in a transparent matter and subject to peer review. A second is that the results of the tests, along with the test plan itself, are made available to the public. A third critically important feature, which derives from the first two, is that a scientifically valid test must be repeatable, verifiable, and its results can be proven as false or true. These criteria clearly apply to spectrum related testing.
6. In connection with my role at Roberson and Associates, I have served as an engineering and technical advisor to Ligado Networks LLC ("Ligado") since 2015. I have reviewed the results of three engineering tests that relate to the operations Ligado proposes in its license modification application, which the company submitted in 2015 and amended in 2018.
7. The first test was conducted by RAA in 2016. That test assessed 27 GPS receivers and devices that include embedded GPS receivers, which were subjected to simulated LTE base station interference from the 1526 to 1536, 1627.5 to 1637.5, 1647.5 to 1657.5 and 1670 to 1680 MHz bands.
8. The test measured two metrics. First, the test measured whether the performance of the GPS device was affected, or to put it in the terms of the FCC's rules, whether the device experienced harmful interference. The testing measured the GPS devices' key performance indicators, such as position and timing error, which indicate whether a device will experience harmful interference. Second, given the interest expressed in the measurement, the test also

captured whether the device experienced more than a 1 dB change in the ratio of the Carrier Power to Noise Power Density ( $C/N_0$ ) as reported by the devices. After public review and feedback a test plan was made available for this testing in August 2015 and submitted for the record, and a report was filed at the Commission with the details of the measurements and results.

9. This testing bears the hallmarks of a scientifically valid test: the tests themselves and the results obtained are repeatable, verifiable, and can be proven as false or true. In my two decades of experience advising companies on matters before the Commission, I have found that a scientifically valid study is important, but to be useful to a decision maker it also must be relevant to the question under consideration. The question before the Commission in considering the Modification Applications is whether the spectrum plan would cause harmful interference to GPS devices. The RAA study thus contributes to the Commission's knowledge on that question.
10. The results of the RAA testing demonstrate that all of the devices tested are not susceptible to LTE interference from base-stations in all four bands studied and in particular in the 1526 to 1536 MHz band (deemed the most sensitive band) operating at power levels of 32 dBW—the power level Ligado originally proposed in 2015—in at least 99% of locations, except for certain high-precision GPS receivers. For high-precision receivers, the RAA testing further showed that such receivers can be made immune to interference by outfitting these devices with appropriate filtered antennas. It further showed that some of the high-precision GPS receivers that would have been susceptible to interference at 32 dBW would no longer be susceptible at 9.8 dBW—the power level proposed in the 2018 amendment—even without a replacement filtered antenna. The reported test data submitted to the Commission also

contains data on the change in  $C/N_0$  metric reported by the devices. The RAA test results show that for most devices,  $C/N_0$  can fluctuate by upwards of 5 dB without having any impact of the device's timing or position accuracy. More critically, the test data demonstrates that  $C/N_0$  fluctuates by up to 3 dB, as measured by some GPS devices, in a "natural state"—*i.e.*, when the device is sitting in an anechoic chamber in the absence of any LTE signals.

11. The second test I reviewed was conducted by the National Advanced Spectrum and Communications Test Network ("NASCTN"), which is primarily staffed by spectrum scientists from the National Institute of Standards and Technology and jointly run by the Departments of Defense and Commerce in Boulder, CO. The NASCTN testing also assessed (a) the actual performance of GPS devices when exposed to wireless signals in the proposed Ligado bands at various power levels (*i.e.*, whether the device experienced harmful interference), and (b) whether the device registered a 1 dB or greater change in the device's  $C/N_0$  measurement. A draft test plan was made available for review for this testing in May 2016, and after various reviews and the receipt of and response to comments, a final test plan was made available in July 2016. Based on the test plan, this testing bears the hallmarks of a valid scientific experimentation: the tests themselves and the results obtained are repeatable, verifiable, and can be proven as false or true. The testing measured the GPS devices' key performance indicators, such as position and timing error, which indicate whether a device will experience harmful interference.
12. The results of the NASCTN testing demonstrate that Ligado's proposed operations would have no impact on the location accuracy of general location and navigation GPS devices. For high-precision receivers, the NASCTN testing demonstrate that such receivers can be made

immune to interference by using filtered antennas for received interference power levels equal to or greater than 32 dBW; it further showed that some of the high-precision GPS receivers that would have been susceptible to interference at 32 dBW would no longer be susceptible at 9.8 dBW—the power level proposed in the 2018 amendment—even without a replacement filtered antenna. The NASCTN test results also report on whether a device reported experiencing a 1 dB or greater change in the  $C/N_0$  measurement. The NASCTN test results show that for most devices,  $C/N_0$  can fluctuate by multiple dBs without any impact of the device’s timing or position accuracy. Moreover, the test data demonstrates that  $C/N_0$  fluctuates by up to 3 dB in a “natural state”—*i.e.*, when the device is sitting in an anechoic chamber in the absence of any simulated “Ligado” signals. Finally, the test results from NASCTN suggest that  $C/N_0$  is not measured or reported by GPS devices in a consistent manner, and that measuring and reporting of  $C/N_0$  differed substantially across manufacturers and even across devices from the same manufacturers.

13. Even though the identity of individual devices was publicly masked by agreement with the various vendors, since the devices identities was available to selected government entities and tested by those entities, in my professional opinion, and based on the criteria outlined above the testing conducted by NASCTN were repeatable and falsifiable and therefore they were scientifically valid. Further, its conclusions show that the GPS devices tested did not experience harmful interference from power levels equal to those in Ligado’s proposed operations, including high precision devices when an appropriate filtered antenna was used. The NASCTN study thus contributes to the Commission’s knowledge on that question.
14. The third test I reviewed was conducted by the Department of Transportation’s (“DOT”) Volpe Center. Numerous reviews were conducted, and comments received leading to a test

plan that was made available in September 2015. The test plan reported that because of how the Volpe Center structured the testing and its arrangement with the GPS manufacturers, the DOT testing results did not identify which GPS receivers were used in the DOT test. For this reason, the DOT testing is not generally repeatable, verifiable, and/or can be proven to be false or true. This is a significant deficiency for a scientifically valid test.

15. Also, unlike the RAA and NASCTN testing, the DOT testing results did not report on whether GPS devices would experience harmful interference, the normal criteria used by the FCC. The Volpe Center made clear that its testing did not attempt to collect data regarding such factors as position or timing accuracy even though these metrics were requested by various organizations including the FCC, and instead reported data only on their preferred metric of whether the tested GPS devices experience a 1 dB change in  $C/N_0$ . The Volpe Center indicated that this approach permits quicker testing but with results that do not measure key performance indicators such as actual location or timing.
16. Because the DOT testing only measured for a 1 dB change in  $C/N_0$ , there is no data available from the DOT testing for any party to draw any conclusion regarding whether GPS devices will experience harmful interference from Ligado's proposed operations. In this regard, the Volpe Center may have value in other contexts, but it does not make a relevant contribute to the Commission's knowledge on the question of whether the proposed spectrum plan will cause harmful interference to GPS devices.



Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 21, 2019.

/s/ *Dennis A. Roberson*  
DENNIS A. ROBERSON



SECRETARY OF DEFENSE  
1000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-1000

JUN - 7 2019

The Honorable Ajit Pai  
Chairman, Federal Communications Commission  
Washington, DC 20554

Dear Mr. Chairman:

As the Global Positioning System (GPS) service provider (via Air Force Space Command), the Air Force has advised my office that the GPS signal and service need to be protected based on the importance of GPS to national security, civil services, and the economic benefits to the Nation. This week, the Senate passed resolution S.Res.216 "affirming the importance of continuous availability, accuracy, efficiency, robustness, reliability, and resiliency of the Global Positioning System constellation." A similar resolution is in process in the U.S. House of Representatives (H.Res.219).

On December 3, 2018 the National Executive Committee for Space-Based Positioning, Navigation, and Timing (PNT EXCOM) sent a letter to Assistant Secretary of Commerce for Communications and Information and Administrator of the National Telecommunications and Information Administration (NTIA) recommending against approving the license modification request of Ligado Networks. The decision and request were clear and unambiguous.

Pursuant to title 10, U.S. Code, section 2281, the Secretary of Defense "shall provide for the operations of [GPS] for peaceful civil, commercial, and scientific uses," but in doing "may not agree to any restriction on [GPS] proposed by the head of a department or agency of the United States outside DoD that would adversely affect the military potential of [GPS]." Consistent with my statutory responsibilities, I believe there are too many unknowns and the risks to GPS are too great to allow Ligado's proposed system to proceed.

The PNT EXCOM was unambiguous in its recommendation against approval of the Ligado proposal based on the risk of significant and unacceptable interference to GPS, a critical National Security System. I therefore request that the Federal Communications Commission reject the license modification request and not allow the proposed system to be deployed. Further, consistent with the PNT EXCOM decision, the Department also recommends that proposals for use of bands adjacent to GPS should not be approved unless they meet the tolerable transmission power limits described in the Department of Transportation's GPS Adjacent Band Compatibility Assessment Final Report (April 2018).

I have consulted with my Chief Technical Officer and Chief Information Officer and both agree. Your personal attention to this matter would be deeply appreciated.

Patrick M. Shanahan

Acting

cc:  
Secretary of Commerce  
Acting Assistant Secretary for Communications and  
Information and Administrator, NTIA



SECRETARY OF DEFENSE  
1000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-1000

NOV 18 2019

Mr. Ajit Pai  
Chairman  
Federal Communications Commission  
445 12th Street, SW  
Washington, DC 20554

Dear Mr. Chairman:

As you know, the Global Positioning System (GPS) signal and service need to be protected based on the importance of GPS to national security, civil services, and the economic benefits to the Nation. Earlier, this year the United States Senate passed Resolution S.Res.216 "affirming the importance of continuous availability, accuracy, efficiency, robustness, reliability, and resiliency of the Global Positioning System constellation". A similar resolution is in process in the U.S. House of Representatives (H.Res.219).

On December 3, 2018, the National Executive Committee for Space-Based Positioning, Timing and Navigation (PNT EXCOM) sent a letter to Assistant Secretary of Commerce for Communications and Information and Administrator of the National Telecommunications and Information Administration (NTIA) recommending against approving the license modification request of Ligado Networks. The decision and request were clear and unambiguous. Acting Secretary of Defense Shanahan, sent a letter to the Secretary of Commerce (April 18, 2019) and a second letter to you as Chairman of the Federal Communications Commission (FCC) (June 7, 2019) requesting that the FCC reject the license modification and not allow the proposed system to be deployed per the PNT EXCOM decision.

Per 10 USC 2281, the Secretary of Defense "may not agree to any restriction on the GPS System proposed by the head of a department or agency of the United States outside DoD that would adversely affect the military potential of GPS". Consistent with my statutory responsibilities, I believe there are too many unknowns and the risks are far too great to federal operations to allow Ligado's proposed system to proceed. All independent and scientifically valid testing and technical data shows the potential for widespread disruption and degradation of GPS services from the proposed Ligado system. This could have a significant negative impact on military operations, both in peacetime and war. I, therefore, strongly oppose this license modification.

I request that the FCC reject the license modification request and not allow the proposed system to be deployed. Further, consistent with the PNT EXCOM decision, the Department also recommends that proposals for use of bands adjacent to GPS should not be approved unless they meet the transmission power levels described in the Department of Transportation's Adjacent Band Compatibility Assessment.

I have consulted with my Chief Technical Officer and Chief Information Officer and both agree. Your personal attention to this matter would be deeply appreciated.

Sincerely,

A handwritten signature in black ink, reading "Mark T. Esper". The signature is fluid and cursive, with the first name "Mark" and last name "Esper" clearly legible.

cc:

Secretary of Commerce

Acting Assistant Secretary for Communications and Information and

Administrator, National Telecommunications and Information Administration

Assistant to the President for National Security Affairs

Acting Chief of Staff, White House